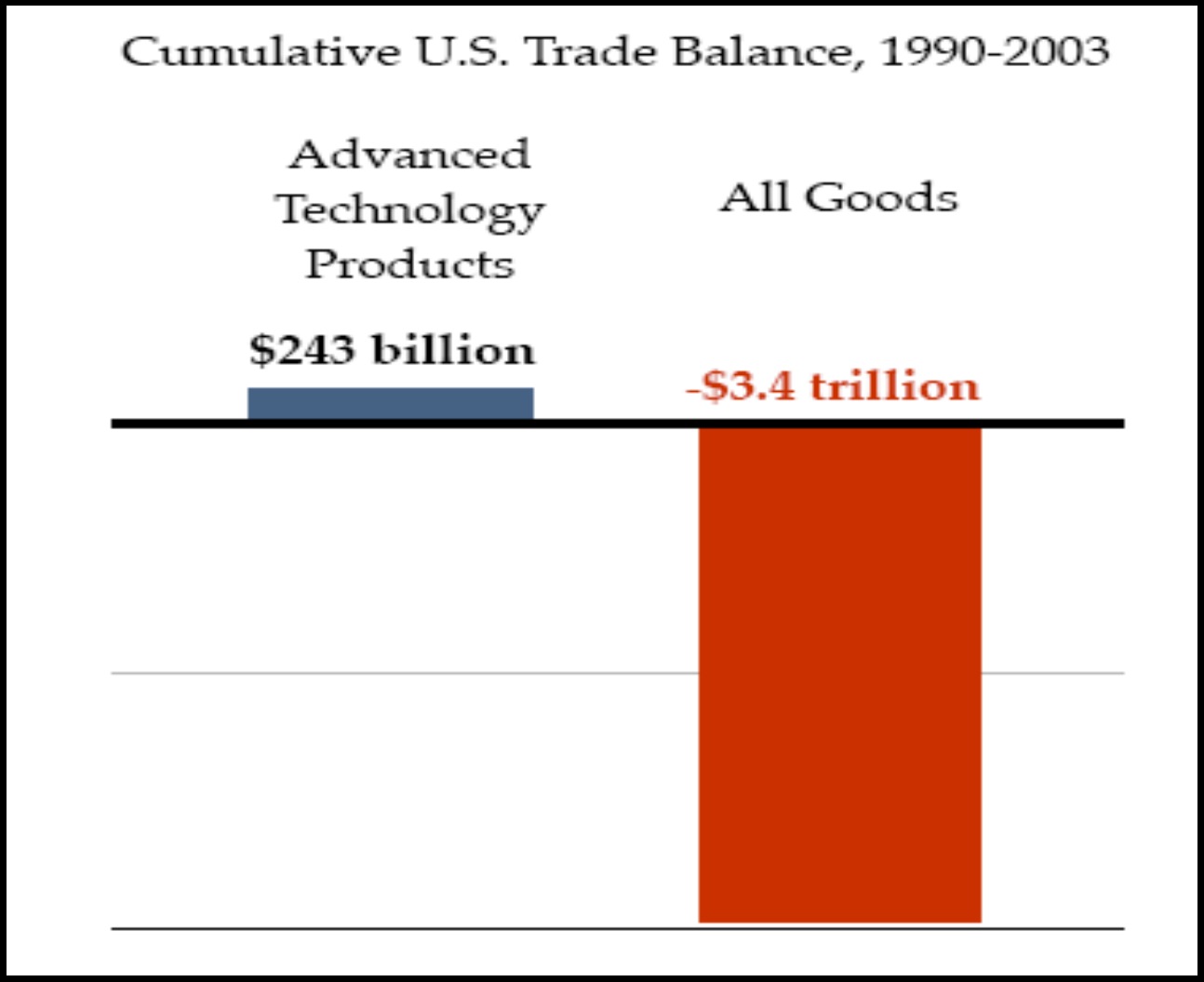
Country Review: USA

11th Micromachine Summit, Dallas TX, USA

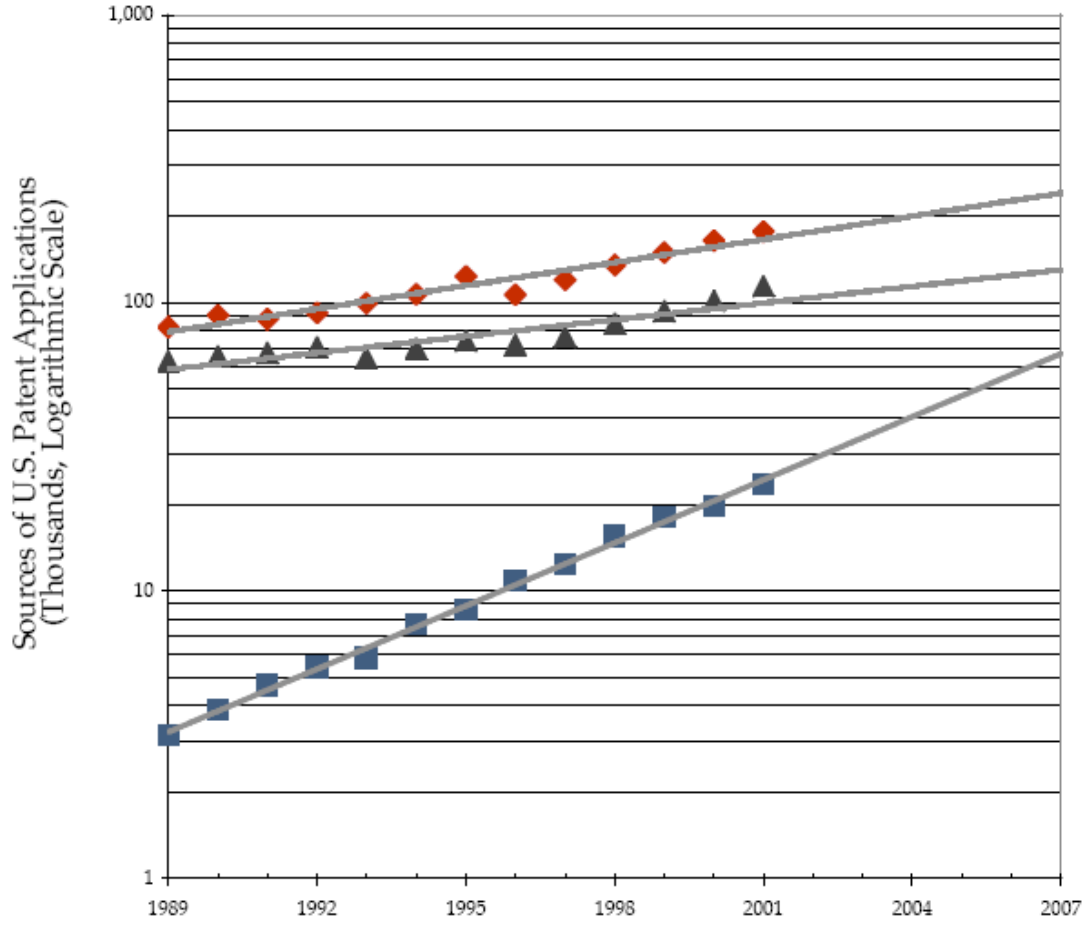
May 1-3 2005

US Delegation: Michael Gaitan, NIST
Steve Walsh, UNM
Tom Cellucci, Zyvex
Bob Sulouff, Analog Devices

High-Tech Contribution to Trade Balance



U.S. Patent Applications

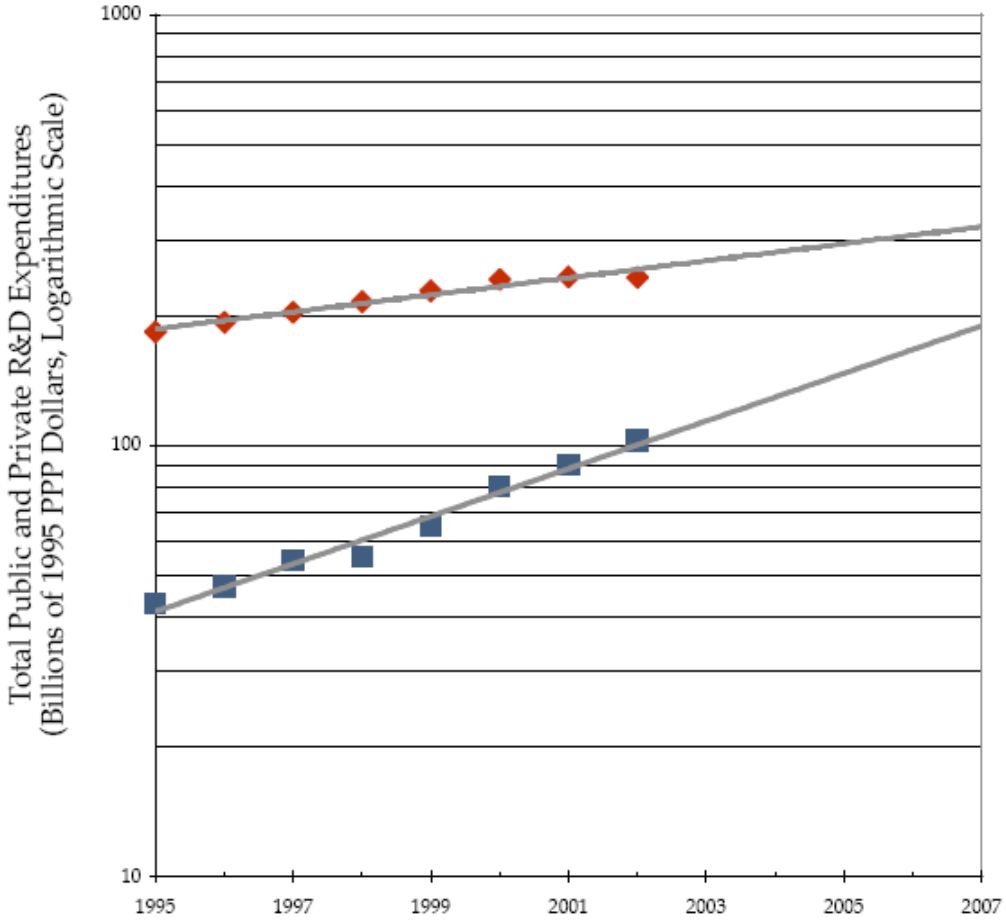


Other Established Economies:
Canada, France, Germany, Italy, Japan, Netherlands, Sweden, Switzerland, United Kingdom

Fastest Growing Economies:
China, Hong Kong, India, Ireland, Israel, Singapore, South Korea, Taiwan

Source: National Science Foundation, *Science and Engineering Indicators 2004*, Appendix Table 6-11.
Compiled by the APS Office of Public Affairs

Total R&D Investments



United States

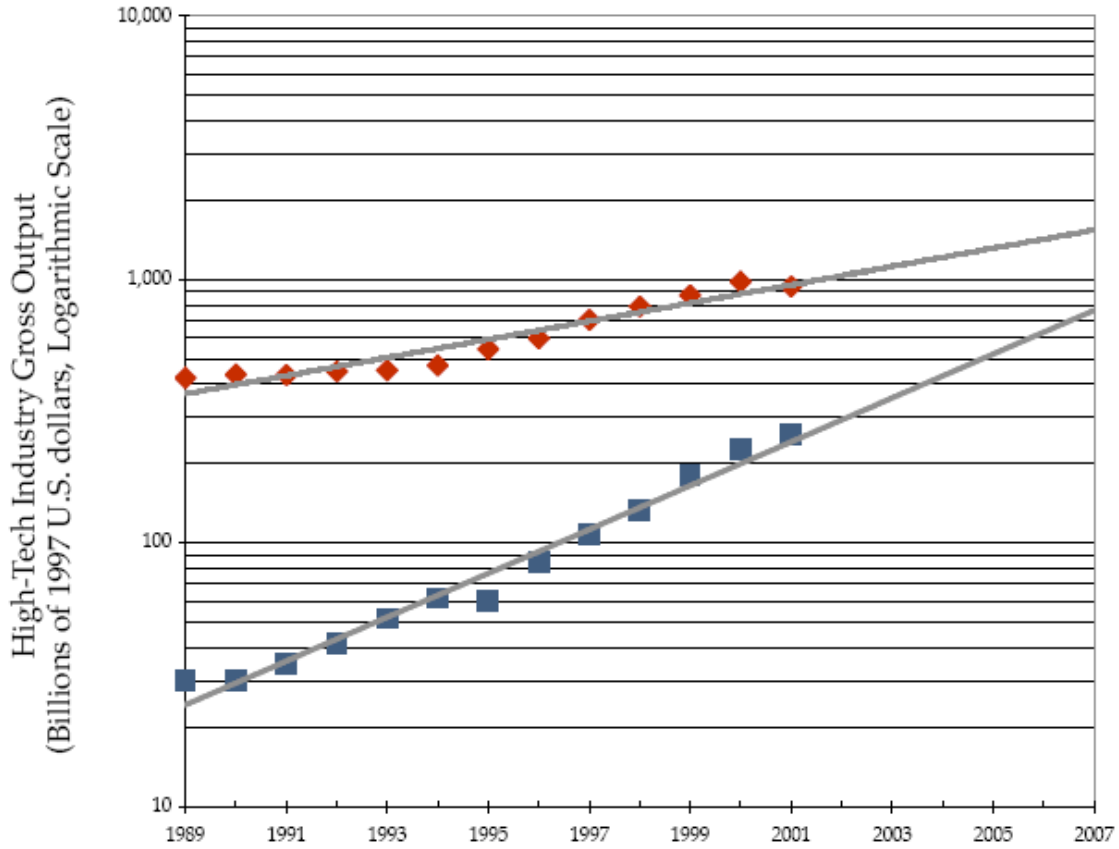
Fastest Growing Economies

Fastest Growing Economies:
China, Ireland, Israel, Singapore, South Korea, Taiwan

(India and Hong Kong data not available)

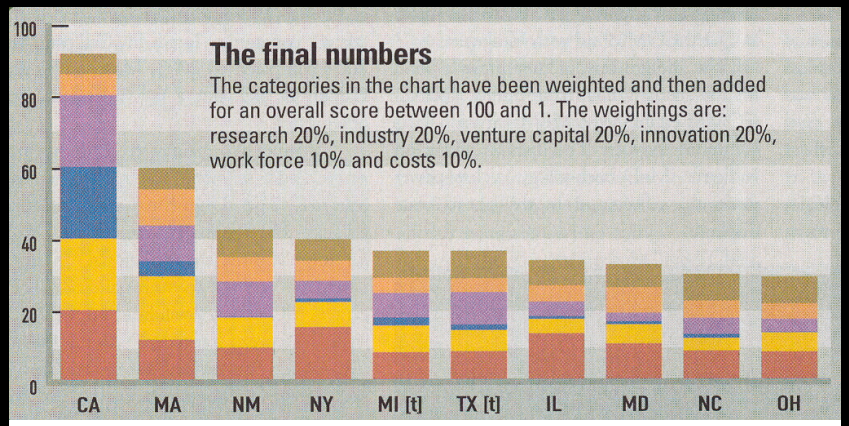
Source: Organisation for Economic Cooperation and Development, *Main Science and Technology Indicators*, May 2003.
Compiled by the APS Office of Public Affairs

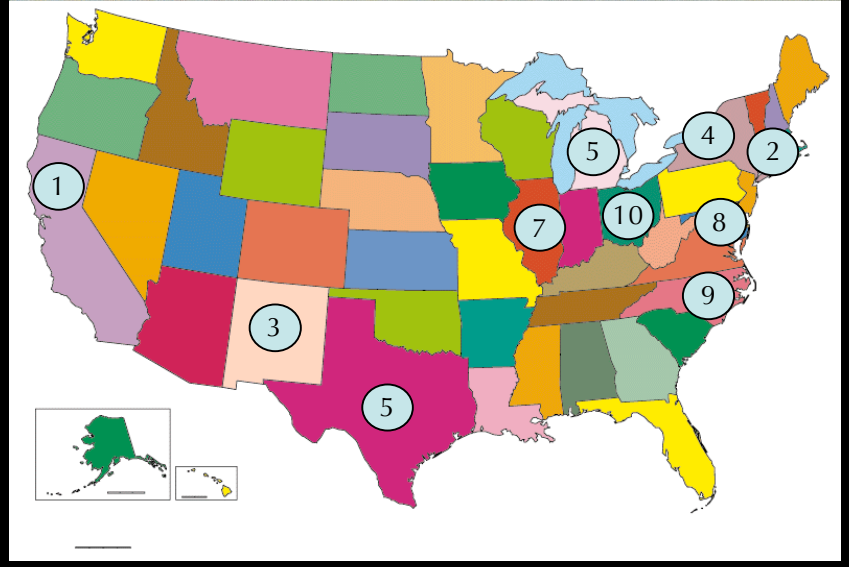
High-Tech Industrial Output



High-tech industry includes aerospace, computers and office machinery; communications equipment; pharmaceuticals ; and medical, precision and optical instruments.

Source: National Science Foundation, *Science and Engineering Indicators 2004*, Appendix Table 6-1.
Compiled by the APS Office of Public Affairs





#1: California

2004*ranking - 1; 2003 ranking - 1* California keeps growing with new companies, research and venture capital dollars.

#2: Massachusetts

2004 ranking - 2; 2003 ranking -2 Amherst, Lowell and other regions have joined Boston as Massachusetts marches toward dominance.

#3 New Mexico

2004 ranking - 3; 2003 ranking - 3 Despite its two national labs, New Mexico remains in third without enough private investment.

#4 New York

2004 ranking - 4; 2003 ranking - 7 Holding its own, New York gets more companies and venture capital dollars to support them, but falls in business grants.

#5 Michigan

2004 ranking - 8; 2003 ranking - 9 Known for all things automotive, Michigan may be diversifying. Growth in industry and commerce helps offset a dip in research funding.

#5 Texas

2004 ranking - 5; 2003 ranking - 5 Texas shares its fifth-place title after losing ground as a research and industry leader. Some venture capital success nudged it back.

#7 Illinois

2004 ranking - 6; 2003 ranking - 8 Its outstanding research institutions have propped up Illinois' standing in past years but can't remain a crutch for much longer.

#8 Maryland

2004 ranking - 11; 2003 ranking - 6 Maryland returns to the top 10 after just missing the cut last year, thanks in part to a new $235 million federal lab.

#9 North Carolina

2004 ranking - 17; 2003 ranking - 20 The pieces fall into place for North Carolina, whose universities and workers are beginning to attract attention from venture capital firms.

#10 Ohio

2004 ranking: 10 - 2003 ranking - 17 Ohio stays on course with modest but respectable gains on its academic and industrial fronts.

smalltimes
BIG NEWS IN SMALL TECH.

from Small Times, Vol. 5, No. 2, March 2005

USA 2005 Science Budget

Total R&D Budgets		$132B
DHS	↑20%	$1.2B
DOD	↑7.1%	$70.3B
NSF	↓1.9%	$5.5B
NIH	↑2%	$28.6B
NASA	↑4.5%	16.1B
DOE	↑2.8%	$3.6B
USGS	↓0.3%	$935M
NIST	↑10%	$379M
NIST ATP	↓24%	$136M

AAAS Analysis of 2005 U.S. Spending Measure Finds Mixed News for R&D, 23 Nov 2004

US Investment in Nanotechnology

NNI Budget Overview by Agency
(dollars in millions)

Agency	2003 Actual	2004 Estimate*	2005 Proposed	% Change, 2004 to 2005
NSF	221	254	305	20%
DOD	322	315	276	-12%
DOE	134	203	211	4%
HHS (NIH)	78	80	89	11%
DOC(NIST)	64	63	53	-16%
NASA	36	37	35	-5%
USDA	0	1	5	400%
EPA	5	5	5	0%
DHS (TSA)	1	1	1	0%
DOJ	1	2	2	0%
TOTAL	862	961	982	2%

*The NNI request for FY 2004, as originally published in the President's FY 2004 Budget, was $792 million (see 2004 Budget, p. 185).

United States Federal Government investment in nanotechnology R&D

1997: $116M
2004: $849M
2005: $982M (2% increase)

65% supports academic research

source: http://www.nano.gov

DHS

Department of Homeland Security

Science and Technology Directorate (S&T)

The Science and Technology Directorate (S&T) is the primary research and development arm of the Department.

- Develop systems to prevent and detect … chemical, biological, radiological, nuclear, and explosive attacks;
- Develop equipment, protocols, and training procedures for response;
- Enhance … other Federal (and) State … agencies to fulfill their homeland security related missions;
- Develop methods and capabilities to test and assess threats … and anticipate emerging threats;
- Develop technical standards and establish certified laboratories to evaluate homeland security and emergency responder technologies, and evaluate technologies for SAFETY Act certification; and
- Support U.S. leadership in science and technology.

Homeland Security

http://www.dhs.gov

↑20% $1.2B

DARPA
Microsystems Technology Office

- Chip Scale Atomic Clock
- Micro Gas Analyzers
- Micro Power Generation
- Micro Electric Propulsion
- Micro Antenna Arrays
- MEMS Exchange
- Nano Mechanical Array Signal Processors
- RF MEMS
- Navigation-Grade Integrated Micro Gyroscopes
- Micro Cryogenic Coolers

http://www.darpa.mil/mto/radprograms.html

National Science Foundation

WHERE DISCOVERIES BEGIN

↓1.9% $5.5B

- Supports university research
  - Diverse portfolio of programs
- Sponsors studies and workshops
  - Workshops on nanotechnology grand challenges
- Fosters development of scientific technologies for research
  - National Nanotechnology Infrastructure Network (NNIN)

National Nanotechnology Infrastructure Network

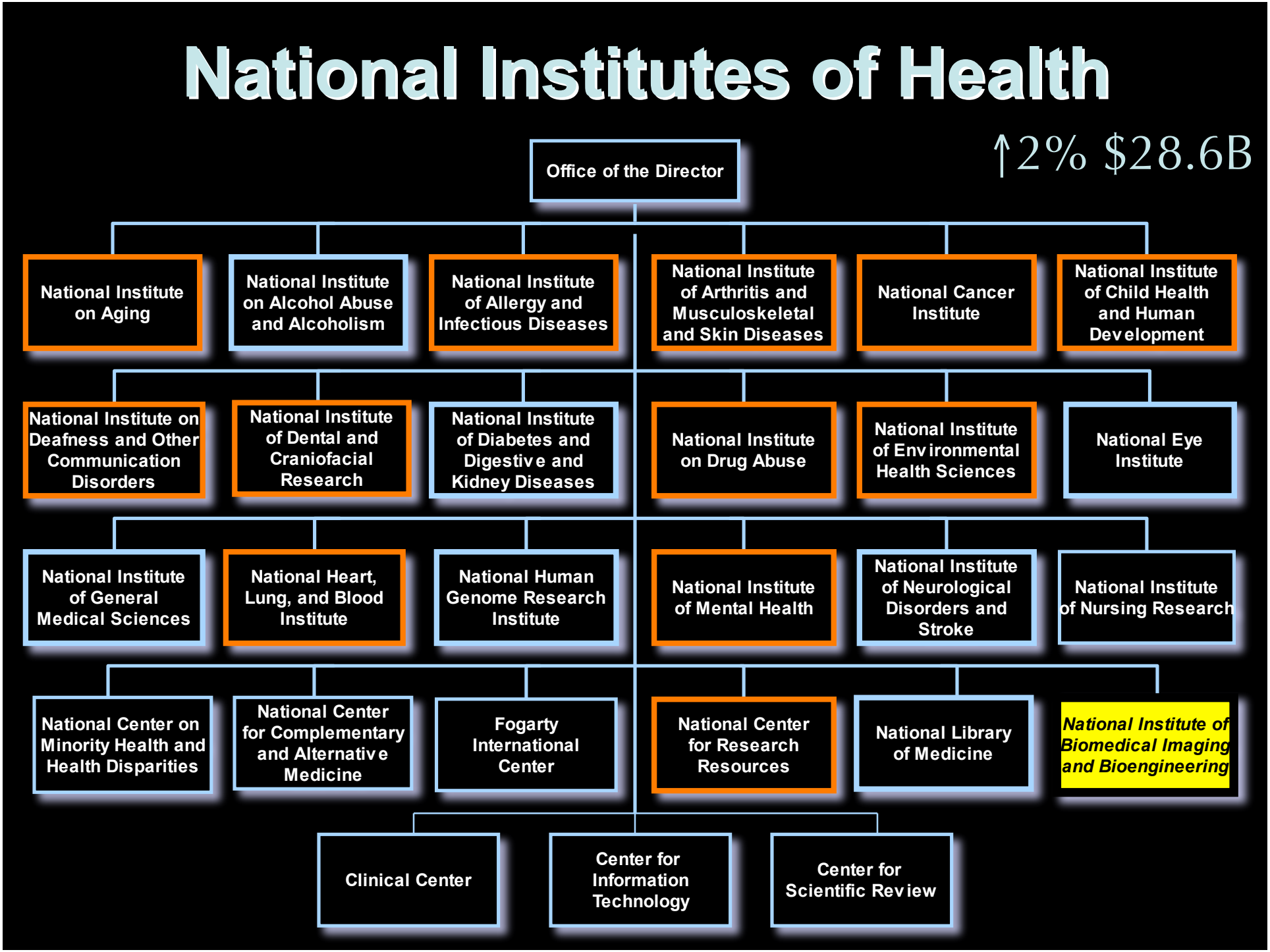
The National Nanotechnology Infrastructure Network (NNIN) is an integrated partnership of thirteen user facilities, supported by NSF, providing unparalleled opportunities for nanoscience and nanotechnology research.

The Cornell Nanoscale Facility at Cornell University
The Stanford Nanofabrication Facility at Stanford University
The Solid State Electronics Laboratory at the University of Michigan
The Microelectronics Research Center at the Georgia Institute of Technology
The Center for Nanotechnology at the University of Washington
The Penn State Nanofabrication Facility at the Pennsylvania State University
Nanotech at the University of California at Santa Barbara
The Minnesota Nanotechnology Cluster (MINTEC) at the University of Minnesota
The Nanoscience at the University of New Mexico
The Microelectronics Research Center at University of Texas at Austin
The Center for Imaging and Mesoscale Structures at Harvard University
The Howard Nanoscale Science and Engineering Facility at Howard University
The Triangle National Lithography Center at NCSU (DUV lithography only) (Affiliate)

http://www.nnin.org

National Institutes of Health

↑2% $28.6B

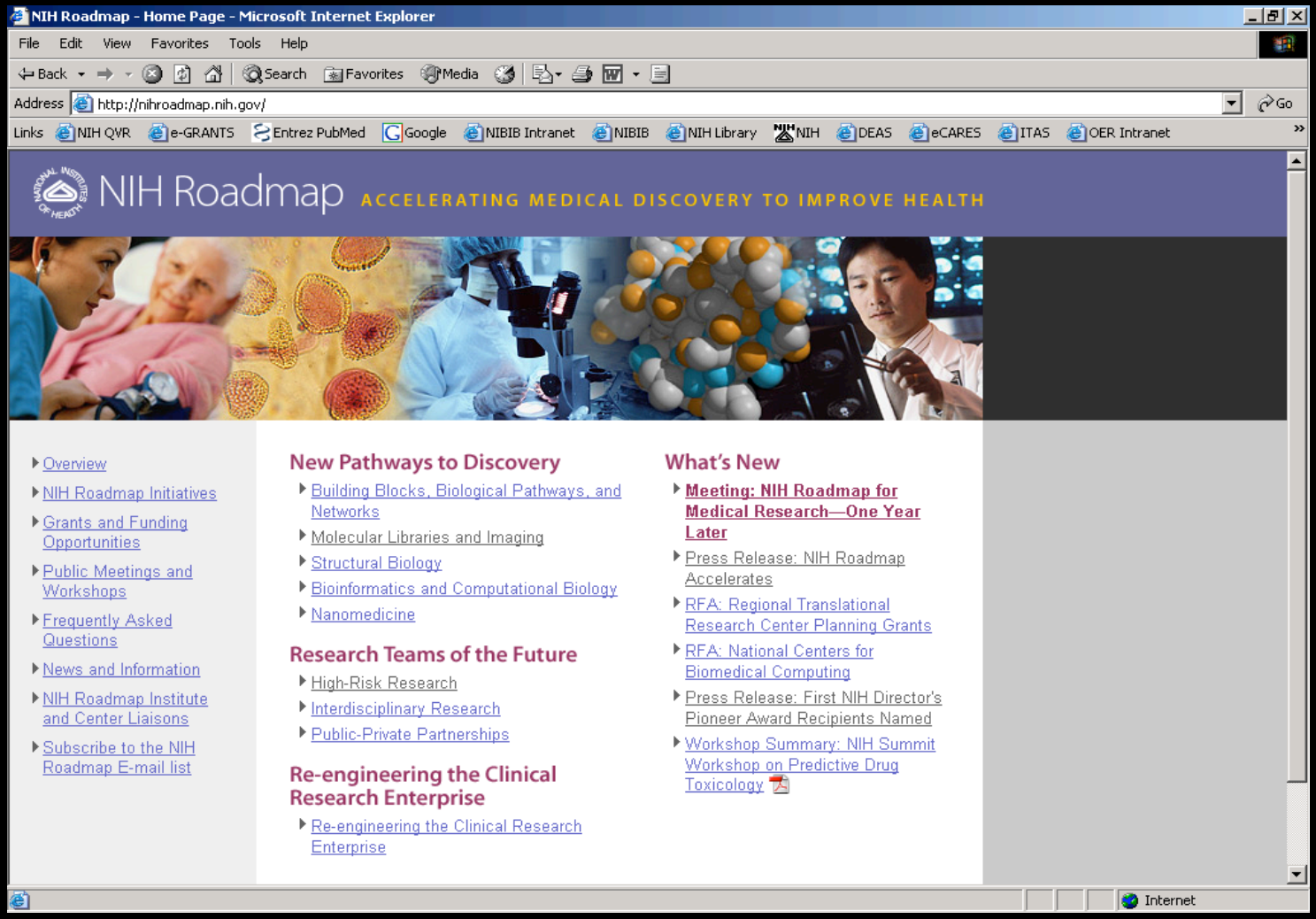


NIBIB Program Areas

- Bioinformatics
- Mathematical Modeling
- Biomaterials
- Biomechanics and Rehabilitation
- Drug and Gene Delivery
- Imaging Agents
- Image-Guided Interventions
- Imaging Devices (MRI, Nuclear Medicine, Optical, Ultrasound, etc.)
- Sensors and Micro(nano)systems
- Telehealth
- Tissue Engineering
- Implant Science

NIH Roadmap

http://nihroadmap.nih.gov/



National Institute of Standards and Technology

NIST

...working with industry to develop and apply technology, measurements and standards

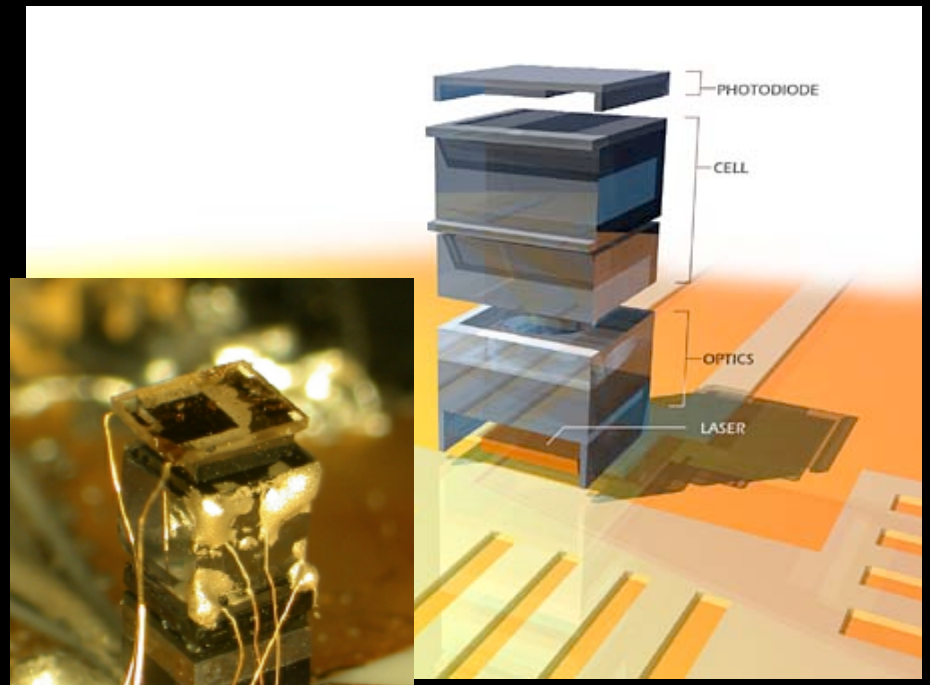
<u>Extramural</u>: Advanced Technology Program -- $4 billion in cost-shared partnerships with industry since 1990, ↓24% $136M

<u>Intramural</u>: NIST Laboratories -- National measurement standards
↑10% $379M

Chip Scale Atomic Clock

To create ultra-miniaturized, low-power, atomic time and frequency reference units that will achieve, relative to present approaches:

- >200X reduction in size (from 230 cm3 to <1 cm3),
- >300X reduction in power consumption (from 10 W to <30 mW), and
- Matching performance (±1´10-11 accuracy Þ <1µs/day).
- Example of future payoff is wristwatch size high-security UHF communicator / jam-resistant GPS receiver.



Chip-scale Atomic clock

United States Measurement System
NIST is Undertaking a new Study

- Roadmapping America's measurements needs
- Respond to needs of Global Trade
- Identify crucial infrastructure needs
- Organize workshops for information gathering
- Convene USMS Summit – January 2006

- Soon to come: MNT Metrology Roadmap

Thank You!

Talk can be viewed online at:

http://mems.nist.gov/Talks/USA2005.pdf